

Musculoskeletal Injuries

Description of an Under-Recognized Injury Problem Among Military Personnel

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Introduction: Although injuries are recognized as a leading health problem in the military, the size of the problem is underestimated when only acute traumatic injuries are considered. Injury-related musculoskeletal conditions are common in this young, active population. Many of these involve physical damage caused by micro-trauma (overuse) in recreation, sports, training, and job performance. The purpose of this analysis was to determine the incidence of injury-related musculoskeletal conditions in the military services (2006) and describe a standardized format in which to categorize and report them.

Methods: The subset of musculoskeletal diagnoses found to be injury-related in previous military investigations was identified. Musculoskeletal injuries among nondeployed, active duty service members in 2006 were identified from military medical surveillance data. A matrix was used to report and categorize these conditions by injury type and body region.

Results: There were 743,547 injury-related musculoskeletal conditions in 2006 (outpatient and inpatient, combined), including primary and nonprimary diagnoses. In the matrix, 82% of injury-related musculoskeletal conditions were classified as inflammation/pain (overuse), followed by joint derangements (15%) and stress fractures (2%). The knee/lower leg (22%), lumbar spine (20%), and ankle/foot (13%) were leading body region categories.

Conclusions: When assessing the magnitude of the injury problem in the military services, injury-related musculoskeletal conditions should be included. When these injuries are combined with acute traumatic injuries, there are almost 1.6 million injury-related medical encounters each year. The matrix provides a standardized format to categorize these injuries, make comparisons over time, and focus prevention efforts on leading injury types and/or body regions.

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Introduction

Injuries are recognized as a leading health problem in the U.S.^{1,2} In 2002, some 161,269 people died as the result of injuries (unintentional and intentional).³ Fatal unintentional injuries ($n=106,742$) constituted the 5th leading age-adjusted cause of death but were the leading cause for those aged between 1 and 45 years.³ Fatal intentional injuries from suicide and homicide ranked 11th and 14th, respectively.³ Each year, an esti-

mated 1.5 million people with injuries are discharged from hospitals, representing the 2nd most common discharge diagnosis,² and 30 million people are treated for injuries in hospital emergency departments, accounting for 30% of all emergency department visits.^{2,4}

Data for the military services similarly demonstrate the magnitude of the injury problem within the U.S. Department of Defense (DoD). In 2003, unintentional injury was the leading cause of death, representing 44% of fatalities among active duty military personnel.⁵ Combat injuries accounted for 22% of deaths, while intentional deaths from suicides and homicides accounted for an additional 16% of fatalities. In 2003, there were more hospitalizations for injury among active duty personnel ($n=9605$) than for any other diagnosis category except pregnancy-related conditions.⁶ In 2004, 555,393 injuries were treated in ambulatory clinics throughout DoD.⁵

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Even though these data clearly demonstrate that injuries are a leading health problem, some civilian and military injury experts believe these data markedly underestimate the actual magnitude of the injury problem.⁷⁻⁹ Injury is typically defined as “bodily harm” resulting from acute exposure to external forces or substances (i.e., mechanical, thermal, electrical, chemical, or radiant) or from absence of such essentials as heat or oxygen caused by a specific event.⁴ Using this definition for nonfatal injuries, only acute traumatic injuries having relatively sudden discernible effects are included in injury reports.^{4,10,11} These injuries are classified in Chapter 17 (Injury and Poisoning) of the ICD-9-CM. However, many injuries that commonly occur in recreation, sports, and the workplace are not classified as traumatic injuries and, consequently, are not included in the injury estimates. Examples of common injuries not included are (1) meniscal tears and other internal derangements of the knee, (2) recurrent shoulder dislocations, (3) rotator cuff tendinitis and tears, (4) Achilles tendinitis, (5) stress fractures, and (6) injury-related cervical and lumbar strains (with or without neurologic involvement). These injuries are classified in Chapter 13 (Diseases of the Musculoskeletal System and Connective Tissue) of the ICD-9-CM.

The Barell Injury Diagnosis Matrix is often used in civilian and military injury surveillance to categorize traumatic injuries (Chapter 17, ICD-9-CM).^{12,13} By categorizing injuries by their type and body region, the matrix allows injury experts to recognize the degree to which specific injuries contribute to the overall injury problem and identify focus areas for prevention. Adding to its utility, the matrix allows comparison of injuries over time and between different populations. However, since the matrix includes acute traumatic injuries, but not injury-related musculoskeletal conditions, it underrepresents the magnitude of the injury problem.

Injury experts in sports and occupational medicine have developed expanded injury definitions that encompass the full array of injuries common in these fields. In addition to the traumatic injuries represented in the Barell Matrix, these definitions include a subset of musculoskeletal conditions (Chapter 13, ICD-9-CM) that is injury-related in the population of interest.¹⁴⁻²⁷ To reinforce the importance of these injury-related musculoskeletal conditions in sports, inclusion of these injuries has become standard in many well-accepted sports-injury surveillance systems, including those maintained by the National Collegiate Athletic Association (NCAA) and international governing bodies for many sports, including soccer and rugby.²⁸⁻³²

Although acute trauma may be a factor in some cases, many of the injury-related musculoskeletal conditions result from the cumulative effects of smaller amplitude

(micro-traumatic) forces. These forces occur with over-training, overexertion, repetitive movements and activities, forceful actions, vibratory forces, extreme joint positions, and prolonged static positioning.^{15-19,21,33-40} These forces, and the injuries they cause, are common in many types of physical activity (i.e., leisure activities, exercise, recreation, and sports)^{26,27,33,35,41-45} and in many occupational settings, including the military.^{36-39,46-53}

During 2001 and 2002, three groups within DoD worked independently to develop a comprehensive list of injury-related diagnosis codes that could be used for injury surveillance in the military services. These groups were the (1) Army Medical Surveillance Activity, (2) DoD Military Injury Metrics Working Group, and (3) Injury Prevention Program, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM). The groups realized the importance of expanding the injury case definition that included only traumatic injuries to also include the subset of musculoskeletal conditions that are typically injury-related in the military population. The combined efforts and products of these groups contributed to DoD's acceptance of a broader injury definition that includes both types of injury for surveillance, analysis, and reporting.^{54,55}

The purpose of this analysis was to (1) describe the process used by USACHPPM to select a standardized set of injury-related musculoskeletal conditions to be used for injury surveillance, (2) describe the development of a matrix to classify injury-related musculoskeletal conditions by injury type and body region, (3) report the musculoskeletal injury incidence and rate among the combined military services (DoD) for calendar year (CY) 2006, and (4) present the DoD musculoskeletal injuries for 2006 using the matrix.

Methods

A team of injury epidemiologists, physicians, and physical therapists at USACHPPM identified the subset of musculoskeletal conditions (Chapter 13, ICD-9-CM) that would be included when describing the burden of injury in the predominantly young and physically active military population. The team reviewed data from (1) established army surveillance systems, (2) field investigations, (3) extensive medical record reviews (more than 8000 medical records), and (4) peer-reviewed scientific literature. At the completion of this review, the team systematically evaluated all injury-related musculoskeletal conditions and selected a subset that would be included in future injury surveillance efforts. Consensus of group members was required in this decision process.

To categorize injury-related musculoskeletal conditions according to their injury type and anatomic location (body

Table 1. Injury-related musculoskeletal condition matrix with assigned diagnosis codes (ICD-9-CM)

Body region	Inflammation and pain (overuse)	Joint derangement	Joint derangement with neurological involvement	Stress fracture	Sprain/strain/rupture	Dislocation
Vertebral column						
Cervical	723.1	722.0	722.71, 723.4	—	—	—
Thoracic/dorsal	—	722.11	722.72, 724.4	—	—	—
Lumbar	724.2	722.10	722.73, 724.3	—	—	—
Sacrum, coccyx	720.2	—	—	—	—	—
Spine, back unspecified	721.7, 724.5	722.2	722.70, 724.9	733.13	—	—
EXTREMITIES						
Upper						
Shoulder	716.11, 719 (.01, .11, .41), 726 (.0, .1, .2)	718 (.01, .11, .81, .91)	—	—	727 (.61-62)	718.31
Upper arm, elbow	716.12, 719 (.02, .12, .42), 726.3	718 (.02, .12, .82, .92)	—	733.11	—	718.32
Forearm, wrist	716.13, 719 (.03, .13, .43), 726.4	718 (.03, .13, .83, .93)	—	733.12	—	718.33
Hand	716.14, 719 (.04, .14, .44)	718 (.04, .14, .84, .94)	—		727 (.63-64)	718.34
Lower						
Pelvis, hip, thigh	716.15, 719 (.05, .15, .45), 726.5	718 (.05, .15, .85, .95)	—	733 (.14-15, .96-.98)	727.65	718.35
Knee, lower leg	716.16, 717.7, 719 (.06, .16, .46), 726.6	717 (.0-6, .9), 718 (.06, .16, .86, .96)	—	733 (.16, .93)	717.8, 727 (.66-67)	718.36
Ankle, foot	716.17, 719 (.07, .17, .47), 726.7, 728.71, 734	718 (.07, .17, .87, .97)	—	733.94	727.68	718.37
UNCLASSIFIED BY SITE						
Others and unspecified						
Other specified and multiple	716 (.18-19), 719 (.08-09, .18-19, .48-49), 726.8, 727.2	718 (.08, .09, .18, .19, .88, .89, .98, .99)	—	733.19	727.69	718 (.38, .39)
Unspecified site	716.10, 719 (.00, .10, .40), 726.9, 727.3, 729.1	718 (.00, .10, .80, .90)	729.2	733 (.10, .95)	727.60, 728.83	718.30

region), and to provide a standardized format for reporting, a matrix modeled after the Barell Injury Diagnosis Matrix was developed (Table 1). In this matrix, injury type categories are identified by column headings along the upper horizontal axis. These categories represent general types of injury-related musculoskeletal conditions and do not reflect specific diagnosis categories from Chapter 13, ICD-9-CM. The first injury type category—inflammation and pain (overuse)—includes injuries that are characterized by inflammation and pain due to physical damage of the body resulting from low magnitude forces (micro-trauma) associated with overuse injuries. Examples of musculoskeletal conditions in this category include traumatic arthropathy (code 716.1), rotator cuff tendinitis (code 726.10), bicipital tenosynovitis (code 726.12), patellar tendinitis (code

726.64), and Achilles tendinitis (code 726.71). The second and third categories include injury-related musculoskeletal conditions that involve a joint derangement without and with, respectively, neurologic involvement. These injuries can result from traumatic or micro-traumatic (overuse) forces and include meniscal tears of the knee (codes 717.0–717.5), loose bodies in the knee (code 717.6), articular cartilage disorders (code 718.0), intervertebral disc disorders of the cervical (code 722.0) or lumbar spine (code 722.1), lumbosacral radiculitis (code 724.4), and intervertebral disc disorders with myelopathy (code 722.7). The 4th category—stress fracture—is a well-recognized overuse injury. Common stress fractures include the tibia (code 733.93) and metatarsals (code 733.94). The last two categories—sprain/strain/rupture and dislocation—consist of

injuries that can result from acute trauma or cumulative micro-trauma. Examples of sprain/strain/rupture include old disruption (re-injury) of the medial collateral ligament (code 717.81) and nontraumatic rupture of the quadriceps tendon (code 727.65) or patellar tendon (code 727.66). A common example of “dislocation” is recurrent shoulder dislocation (code 718.31).

The body region categories and subcategories are identified by row headings along the left vertical axis of the matrix. The major body region categories are the vertebral column, upper extremity, and lower extremity. The last category, “other and unspecified,” includes injuries that cannot be classified by body region from their ICD-9-CM diagnosis codes. In comparing the body region categories and subcategories in the injury-related musculoskeletal condition matrix to the corresponding categories in the Barell Injury Diagnosis Matrix, a few important differences are noted:

1. The injury-related musculoskeletal condition matrix does not include the “head and neck” body region category and its two corresponding subcategories (“traumatic brain injury” and “other head/face/neck”). These injuries are classified as traumatic injuries.
2. The matrix does not include the “spinal cord” subcategory of the “spine and trunk” body region category as these are classified as traumatic injuries.
3. The matrix does not include the “torso” body region category as injuries in this body region are usually internal injuries, not musculoskeletal injuries.
4. The “upper” and “lower” subcategories of the “extremity” body region differ somewhat from those in the Barell Injury Diagnosis Matrix because of classification differences between Chapters 13 and 17 of the ICD-9-CM.

The number of injury-related musculoskeletal injuries among active duty (excludes Reserve and National Guard) service members (Air Force, Army, Marines, and Navy) during CY2006 was provided by the Armed Forces Health Surveillance Center (AFHSC), which maintains the Defense Medical Surveillance System (DMSS).⁵⁶ Using diagnosis codes for the preselected subset of injury-related musculoskeletal conditions, AFHSC identified injuries from the inpatient and outpatient electronic medical records in the DMSS. To minimize duplicate counts of the same injury for people with more than one medical encounter (hospitalizations and/or outpatient visits), encounters for the same three-digit diagnosis code (ICD-9-CM) within 60 days of the first encounter were excluded. To capture all injuries for CY 2006, both primary and nonprimary diagnosis codes were considered.

Using the diagnosis codes assigned to cells in the matrix, the number of injuries was entered into the appropriate cells. Totals and proportions were calculated for each injury type category (columns) and for each body region subcategory (rows). Data were also entered into a simplified matrix that combined body region subcategories into four major

categories (vertebral column, upper extremity, lower extremity, and others/unspecified). This simplified matrix was used to make general observations about injuries affecting the major body regions.

The 2006 injury rate for these injury-related musculoskeletal conditions (injuries per 1000 person-years) was calculated using the total number of injuries in the matrix and the 2006 nondeployed person-time (1,183,780 person-years) obtained from the Armed Forces Health Surveillance Center.

Results

Overall, there were 743,547 injury-related musculoskeletal conditions (injuries) in 2006 among active duty, non-deployed service members (Air Force, Army, Marines, and Navy), including primary and secondary diagnoses from medical encounters. The injury rate was 628 injuries per 1000 person-years.

The injury-related musculoskeletal matrix provides frequencies of these injuries categorized by injury type and body region. Table 2 is the simplified matrix in which body region subcategories were collapsed into the major body region categories. Injuries involving the vertebral column and lower extremity accounted for nearly equal proportions of all injuries (40% and 39%, respectively), while upper extremity injuries comprised 14% of the total. Inflammation and pain (overuse) was the largest injury type category, including 82% of all injuries. The other injury type categories represented smaller proportions ranging from 9% for other joint derangement to 0.4% for dislocation. Inflammation and pain (overuse) injuries of the lower extremity ($n=256,268$; 35%) and vertebral column ($n=228,969$; 31%) were the leading two individual cells in the simplified matrix. Examples of injuries in these categories included trochanteric bursitis of the hip, patellar tendinitis, Achilles tendinitis, plantar fasciitis, joint effusions of the knee and ankle, and common overuse disorders of the neck and back. The next largest matrix cell, joint derangement with neurologic involvement in the vertebral column, included 38,731 (5%) injuries.

In the matrix with all body region subcategories (Table 3), the six largest subcategories were the knee/lower leg, lumbar region, ankle/foot, spine/back unspecified, shoulder, and cervical region. Together these accounted for 82% of all injury-related musculoskeletal conditions. The knee/lower leg and ankle/foot subcategories represented 57% and 33%, respectively, of lower extremity injuries, and 22% and 13%, respectively, of all injuries in the matrix. Injuries involving the lumbar region accounted for 49% of vertebral column injuries and 20% of all injuries, while cervical injuries comprised 17% of vertebral col-

Table 2. Simplified injury-related musculoskeletal condition matrix for the active duty Air Force, Army, Marines, and Navy, 2006^{a,b}

Body region	Inflammation and pain (overuse)	Joint derangement	Joint derangement with neurological involvement	Stress fracture	Sprain/strain/rupture	Dislocation	Total	Total %
Spine and back								
Vertebral column	228,969	31,502	38,731	283	0	0	299,485	40.3
Extremities								
Upper	91,035	8,338	0	55	3301	2479	105,208	14.1
Lower	256,268	24,382	0	6,979	1935	787	290,351	39.0
Unclassified by site								
Others and unspecified	35,572	638	5,048	6,665	544	36	48,503	6.5
Total	611,844	64,860	43,779	13,982	5780	3302	743,547	—
Total %	82.3	8.7	5.9	1.9	0.8	0.4	—	100

^aIncludes injury-related musculoskeletal conditions from outpatient visits and hospitalizations; primary and nonprimary diagnoses were included.

^bMedical encounters (outpatient visits or hospitalizations) for the same injury-related musculoskeletal condition diagnosis (ICD-9-CM) within 60 days of the first hospitalization or outpatient visit were excluded to minimize duplicate counts of the same injury.

umn injuries and only 7% of all injuries. The shoulder was the largest subcategory of the upper extremity, comprising 63% of upper extremity injuries and 9% of all injuries.

The seven highest frequency cells in the full matrix were in the inflammation and pain (overuse) category and involved the following body region subcategories, in decreasing order: knee/lower leg, lumbar spine, ankle/foot, spine unspecified, shoulder, cervical spine, and pelvis/hip/thigh. Following these, the next three leading cells were joint derangement of the lumbar spine, pain and inflammation (overuse) of the forearm, and joint derangement with neurologic involvement of the thoracic spine.

Discussion

This paper offers the first description and implementation of a matrix to categorize injury-related musculoskeletal conditions by injury type and body region. The injuries included in the matrix are the subset of musculoskeletal conditions from Chapter 13, ICD-9-CM, that are injury-related for active duty military personnel. Similar to the Barell Injury Diagnosis Matrix, this matrix allows injury experts to recognize the degree to which injury-related musculoskeletal conditions, categorized by injury type and/or body region, contribute to the injury problem. It also assists in identifying injury types that can be targeted for prevention and provides a stan-

dardized format for comparing injury incidence over time and between populations.

Although some of these injuries may result from acute traumatic causes, they more often result from the cumulative effects of micro-traumatic forces that are common in many physical activities and work settings. In the sports medicine literature, injuries of this latter type are commonly referred to as “overuse injuries.” When these injuries are employment-related, they are often referred to as “repetitive strain injuries,” “cumulative trauma disorders,” or “work-related musculoskeletal disorders.”^{15,16,33,34,38,41,49} Activities commonly associated with these injuries can involve (1) overtraining, (2) overexertion, (3) repetitive movements and activities, (4) forceful actions, (5) vibratory forces, (6) extreme joint positions, and (7) prolonged static postures.^{15–19,21,35,37–41,49,57} In addition to their direct effect in causing new injuries, these micro-traumatic forces may also exacerbate or extend previous injuries or cause previous injuries to recur, such as in recurrent joint (shoulder) dislocations and recurrent back strains.^{58–60}

While there were 743,547 musculoskeletal injuries among nondeployed military service members in 2006, when both primary and nonprimary diagnoses were considered, there were only 540,000 injuries where a musculoskeletal condition was the primary diagnosis. This seemingly high number of injuries does not include the acute traumatic injuries classified in Chapter 17, ICD-9-

Table 3. Injury-related musculoskeletal condition matrix for the active duty Air Force, Army, Marines, and Navy, 2006^{a,b}

Body region	Inflammation and pain (overuse)	Joint derangement	Joint derangement with neurological involvement	Stress fracture	Sprain/strain/rupture	Dislocation	Total	Total %
Vertebral column								
Cervical	36,932	5,390	7,972	0	0	0	50,294	6.8
Thoracic/dorsal	0	751	15,244	0	0	0	15,995	2.2
Lumbar	114,562	18,078	12,684	0	0	0	145,324	19.5
Sacrum, coccyx	4,720	0	0	0	0	0	4,720	0.6
Spine, back unspecified	72,755	7,283	2,831	283	0	0	83,152	11.2
EXTREMITIES								
Upper								
Shoulder	54,460	7,014	0	0	2644	2,368	66,486	8.9
Upper arm, elbow	7,392	313	0	18	0	33	7,756	1.0
Forearm, wrist	18,037	691	0	37	0	28	18,793	2.5
Hand	11,146	320	0	0	657	50	12,173	1.6
Lower								
Pelvis, hip, thigh	26,509	394	0	179	229	23	27,334	3.7
Knee, lower leg	140,161	17,490	0	6,800	1335	535	166,321	22.4
Ankle, foot	89,598	6,498	0	0	371	229	96,696	13.0
UNCLASSIFIED BY SITE								
Others and unspecified								
Other specified/multiple	5,882	273	0	404	114	16	6,689	0.9
Unspecified site	29,690	365	5,048	6,261	430	20	41,814	5.6
Total	611,844	64,860	43,779	13,982	5780	3,302	743,547	—
Total %	82.3	8.7	5.9	1.9	0.8	0.4	—	100

^aIncludes injury-related musculoskeletal conditions from outpatient visits and hospitalizations; primary and nonprimary diagnoses were included.

^bMedical encounters (outpatient visits or hospitalizations) for the same injury-related musculoskeletal condition diagnosis (ICD-9-CM) within 60 days of the first hospitalization or outpatient visit were excluded to minimize duplicate counts of the same injury.

CM. To determine the overall injury incidence for the military services, the number of acute injuries must be added to the number of injury-related musculoskeletal conditions, herein reported. When this is done, there are nearly 1.6 million injuries per year.⁶¹

Investigations within the military have provided convincing evidence that a large proportion of injuries among service members is due to injury-related musculoskeletal conditions and that most have an identifiable cause of injury.^{33,34,41,46,48,49,57,62-75} In one investigation, ICD-9-CM diagnosis codes from the electronic Stan-

dardized Ambulatory Data Record (SADR) were compared to the medical provider's hand-written patient history and diagnosis in the outpatient medical record for 408 outpatient encounters (military police and armor personnel).⁷⁶ Reviewers looked specifically at encounters that had been assigned ICD-9-CM diagnosis codes in the "diseases of the musculoskeletal system and connective tissue" code series. Of the 408 cases, 330 (81%) were described as injuries in the patient history notes in the outpatient medical record. In 80% of these cases (266/330), a specific injury cause was noted by the medical

provider. Considering the specified injury cause and diagnosis, medical record reviewers classified 222 (67%) of these injuries as overuse injuries and 103 (31%) as traumatic injuries, and 5 (2%) were not classifiable. It was not surprising that nearly one third of these injuries were classified as traumatic injuries, given that musculoskeletal conditions such as shoulder dislocations and lumbar strains are often attributed to a traumatic event.

Based on results of these past studies, many injury researchers and epidemiologists in the DoD now routinely include injury-related musculoskeletal conditions and traumatic injuries in their injury case definition when reporting the injury incidence and burden in military subpopulations.^{47,63–66,77–79} In two recent investigations of injuries among members of the U.S. Army Band in 2004 and 2005, injury-related musculoskeletal conditions accounted for 61% and 56% of all injuries, respectively.^{63,80} Causes of these injuries included (1) physical activity (e.g., leisure, recreation, exercise, and sports), (2) job-specific activities, and (3) other military training (e.g., drill and ceremony, weapons ranges). A considerable under-representation of the actual injury problem would have resulted if the injury-related musculoskeletal conditions had not been included in this and other investigations.

Adding further support to the inclusion of these injury-related musculoskeletal conditions in injury surveillance and reporting, evaluations involving subpopulations within the military have identified specific risk factors and causes for many of these musculoskeletal conditions. These injuries can be markedly reduced through targeted interventions.^{47,57,64,66,77,78,81,82} For example, lower extremity overuse injuries associated with running, marching, and other lower-extremity load-bearing activities accounted for up to 75% of injuries among men and 78% of injuries among women during Army basic training.⁶⁸ Prevention strategies that included slower progression of running distance, reduced total running volume, running in ability groups, and greater variety in types of training exercises (i.e., multi-axial, neuromuscular, proprioceptive, and agility exercises) reduced the incidence of these injuries by 52% in men and 46% in women.⁷⁸

Although senior DoD leaders already recognized injuries as the leading health problem for the military, they had a greater appreciation for the magnitude of the problem after musculoskeletal conditions were included in surveillance and reporting. This heightened awareness resulted in a more focused approach to preventing injuries. The injury-related musculoskeletal matrix and Barell Injury Diagnosis Matrix are used to identify leading injury types that are associated with specific activities, mechanisms, and subpopulations of the military.

The importance of injury-related musculoskeletal conditions is not unique to the military services. These injuries are common in leisure activities, sports and recreation, and occupational settings in the civilian population.^{8,18,33,35,37,46,51} To appreciate the injury burden for these civilian activities and occupations, injury surveillance and reporting should include these injuries. An injury-related musculoskeletal matrix can provide a standardized format for reporting and comparing injury trends over time. The subset of musculoskeletal conditions included in the matrix, however, may differ based on the specific population of interest. These injuries should also be considered when prioritizing injury types and causes that will be targeted for prevention.

Conclusion

In 2006, there were 743,547 injuries (including primary and nonprimary diagnoses) among nondeployed military services members that involved injury-related musculoskeletal conditions selected from Chapter 13, ICD-9-CM (rate: 628 injuries per 1000 person-years). To recognize the full extent of the active duty DoD injury problem, however, this injury incidence must be added to the traumatic injury (Chapter 17, ICD-9-CM) incidence. Combined, the overall injury incidence would be almost 1.6 million injuries per year.

The injury-related musculoskeletal condition matrix is a useful tool for classifying the injury-related musculoskeletal conditions by their injury type and body region. The matrix should be used to compare injuries over time and between different populations. It enables injury investigators and policymakers to focus attention on the highest frequency injuries and injury types to develop prevention strategies. Injury cause data can be used to target prevention of these injuries in risky activities.

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